

GEOMORPHOLOGICAL AND ARCHAEOLOGICAL EVALUATIONS

GLENVILLE, NEWCASTLE COUNTY, DELAWARE

A. PROJECT BACKGROUND

This report presents the results of geomorphological and archaeological evaluations on portions of the floodplain of the Red Clay Creek at Glenville, New Castle County, Delaware (Figures 1 and 2). The areas investigated were defined as a result of a wider assessment of the landform undertaken in May 2005 by John Stiteler and a team from Hunter Research, Inc. (Hunter Research, Inc. 2005). This assessment identified a possible stable mid- to late Holocene landform towards the northern end of the floodplain area. The report recommended its further evaluation through archaeological investigations in order to better assess its date and potential to contain intact cultural soils and materials.

The work was undertaken on contract to Duffield Associates, Inc. for the Delaware Department of Transportation. The project area is being considered for three purposes: as a source of borrow material for the adjacent Glenville Estates housing development; as a wetland replacement area; and the northernmost portion as a wetland "bank" that could be converted to wetland at a future date (Figure 3). Federal involvement in the project required the identification of historic properties and assessment of effects of the proposed undertakings under Section 106 of the National Historic Preservation Act of 1966 (as amended). These requirements were fulfilled by procedures set out under 36 CFR 800, Protection of Historic Properties.

B. THE STUDY AREA

The overall study area is a U-shaped area of roughly 4 hectares (10 acres) comprising several alluvial landforms along the left bank of Red Clay Creek, a fourth order tributary of the Christina River with headwaters 21 kilometers (approximately 13 miles) to the north in Chester County, Pennsylvania. According to the University of Delaware Water Resources Agency, Red Clay Creek drains an area of 140 square kilometers. Much of the drainage basin is steeply sloping and underlain by poorly permeable crystalline rock, resulting in high flows in Red Clay Creek during storm events. The creek exits the Piedmont physiographic province and enters the Inner Coastal Plain less than 1 kilometer (0.6 miles) upstream from the study area, skirting the western edge of the study area before swinging away to the west to a confluence with White Clay Creek. A second order tributary enters the creek on the right bank opposite the upstream end of the study area. The western leg of the "U" – an open, grassy area maintained as a lawn and recreation area – lies adjacent to Red Clay Creek while the eastern leg occupies a poorly drained, brushy hollow containing a small tributary stream.

Upon initial inspection of the study area, the elevation of the western surface above the stream suggested that it was a T-1 alluvial terrace. However, lack of a lower stable surface proximal to the creek and information provided by an informant that the surface is inundated, on average, at least once every two years argue that it may more accurately be described as a high floodplain. The surface of the study area slopes very gently in the downstream direction, declining from an elevation of about 3 meters (10 feet) above the stream bed at the upstream end to an elevation of about 1.5

meters (5 feet) above the bed at the point where the creek turns west at the mouth of the poorly drained hollow. A low but perceptible natural levee is present at the proximal edge of the floodplain. Soils of the study area have been mapped by the USDA-SCS as Codorus silt loam, described in the USDA-NRCS Soil Series Classification Database as a very deep, moderately well and somewhat poorly drained soil formed in recently deposited alluvium washed from uplands underlain by schist, gneiss, limestone and quartzite.

The floodplain is backed by and surrounds a higher landform that appears to be an older alluvial terrace. This terrace, which is peninsular in form, has a surface that generally lies 2-2.5 meters (6.6-8.2 feet) above the floodplain and is the site of the now-defunct Glenville Estates residential development. The surface of the narrow upstream end of the study area floodplain is roughly equivalent in elevation to the higher terrace, probably largely as a result of historic deposition and filling. Over most of the study area, a well-defined scarp marks the boundary between the terrace and floodplain.

Floodplain settings such as these have the potential to contain prehistoric occupation sites from about 6000 years before present onwards. These developed on stable or near-stable land surfaces in settings that were subject to periodic or seasonal low-energy overbanking episodes. Regionally, this phenomenon has been most extensively studied and synthesized for the Delaware River Watershed (Stewart 1990).

Five major tributaries drain southwards into the Christina from the Piedmont of northern New Castle County and adjacent Pennsylvania. From west to east these are White Clay, Pike, Mill, and Red Clay Creeks, and the Brandywine River. In 1989 the Delaware Bureau of Archaeology and Historic Preservation commissioned an assessment of the archaeological resource potential of the floodplains of these drainages (Custer 1989). This study comprised

field inspections, review of existing data, and research on soil types in order to characterize their prehistoric archaeological sensitivity. The numerous historic mill sites and waterpower systems along these streams were characterized not so much as archaeological resources as agents of destruction of the prehistoric landforms and archaeological sites.

Overall, the potential of the floodplains was assessed as rather low, with areas of high sensitivity being "few and far between" (Custer 1989:34). Many portions of the floodplains are disrupted by historic and modern development. Where soil profiles are available they appear to reflect high-energy environments where much erosion and/or modern deposition has taken place. Archaeologically sensitive zones were defined by Custer on the basis of previously documented prehistoric sites, the apparent absence of major historic and modern disturbance and the mapped presence of floodplain soils of the Codorus and Comus series.

The lower portions of Red Clay Creek immediately upstream of the Glenville project area were characterized as heavily disturbed, with zones of potential existing only north of Lancaster Pike (Custer 1989:13-19). A documented soil profile at the Route 41 bridge (Custer 1989:Figure 8), about two miles north of Glenville, showed coal in the profile to a depth of 90 centimeters (35 inches). Custer however notes the presence of prehistoric sites in non-floodplain settings in the Inner Coastal Plain area where Glenville is located.

The floodplain at Glenville therefore provided an opportunity to examine Codorus soils, identified in the Custer study as holding prehistoric archaeological potential, in a location immediately beyond the Piedmont. The generally high-energy and disturbed floodplain settings of the southern portions of the Piedmont streams suggested that their potential would be low, but the gentler gradient and more open setting of the Coastal Plain at Glenville might have created

more favorable settings the preservation of ancient surfaces and low-energy sediment accumulation, and therefore for prehistoric occupation. The overall objective of the investigation was to test this hypothesis.

C. SUMMARY OF GEOARCHAEOLOGICAL INVESTIGATIONS, SPRING 2005

In the initial investigation, 12 of the 15 backhoe trenches (BHTs) were excavated in three transects of four trenches to provide cross-sectional profiles of the floodplain. Since soil profile characteristics differed sharply between the brushy southeastern and open northwestern halves of the study area, these areas will be discussed separately.

In the northwestern half, most of the profiles were capped by historic to recent alluvium and fill varying in thickness from 12 to 80 centimeters (5-32 inches). A buried plow zone (Apb horizon) of historic age was identified in most of the profiles directly beneath the recent alluvium and fill. In general, the profiles beneath the recent deposits comprised Apb/Bwb1/Bwb2/C sequences. In some cases, a BCb horizon was also present immediately overlying the C horizon. In almost all cases, the pre-contact alluvial sediments beneath the plow zone constituted a single fining-upward sequence ranging from cobbly sand, loam or loamy sand at the base to silt loam or very fine sandy loam in the Bwb1 horizon. The plowzone was frequently slightly coarser than the underlying Bwb1 horizon, suggesting that the plow zone is made up, at least in part, of alluvium produced by historic floods of increased frequency and energy. The portion of the pre-contact sediments made up of overbank deposition (generally speaking, the silt loam to sandy loam Bwb1 and Bwb2 horizons) constituted 60 to 90 centimeters (24-36 inches) of the profile. The coarser sediments beneath this (coarse sandy loam to sand, often containing a small amount of rounded gravel)

are interpreted to be lateral deposition (point bar or side bar) and the basal material (loam to coarse sand texture with varying content of rounded gravel and cobbles) to be sub-aqueous bar or bed deposits.

Two trenches (BHT 14 and 15) were placed close to the foot of the older alluvial terrace edge on which the housing development lies. The topography here, and the quantities of cobbles in the Bwb1 and 2 horizons, indicate that this is a flood chute subject to high-energy episodes. Trench 13, on the narrow landform north of the ditch, showed a sequence similar to those in Transect 1, but this had been truncated at the northern end of the profile, where more modern fill appears to be deepening towards the north.

The southeastern half of the study area is poorly to very poorly drained and includes large areas of standing water. Much of this area has been delineated as wetland. BHT excavations there revealed shallow profiles of gleyed or heavily reduced soils and in most cases trenching encountered shallow groundwater. The profiles also revealed numerous examples of abandoned stream channels filled with fine-textured alluvium or 20th-century fill. Several organic samples were retrieved from anaerobic environments at depths of 1 to 1.5 meters for submission for carbon dating.

On the basis of the preliminary soils and geomorphology study, it was Stitleler's assessment that the eastern leg of the study area – the poorly drained hollow – possessed low to no archaeological potential. This area includes the brushy, wooded area at the southern end of the western leg, which marks the transition to the poorly drained area and the tributary hollow. In addition to being poorly drained, the area shows evidence of surface instability. The agents of instability include historic disturbance and filling, frequent stream channel shifting by the tributary and, possibly, high energy, scouring floods. Within the recent past the hydrology of the hollow has been extensively altered and dis-

rupted by construction at the north end. It was therefore recommended that no additional investigation be carried out in this half of the study area.

It was also Stiteler's assessment that the northwestern part of the study area was a relatively stable mid- to late Holocene landform with a flood chute at its junction with the base of the higher peninsular terrace on which the Glenwood Estates development is located. Intact pre-contact alluvial sediments were identified beneath a cap of historic sediment and fill. The majority of the pre-contact deposits were interpreted to be a product of moderate to low-energy overbanking floods and to have the potential to contain prehistoric occupation evidence. The overlying historic plow-zone, in some cases a mixture of pre- and post-contact sediments were also judged to have the potential to contain displaced prehistoric and historic materials. It was therefore recommended that further archaeological investigations be carried out in the western half of the study area.

D. PHASE I GEOARCHAEOLOGICAL AND ARCHAEOLOGICAL ASSESSMENT OF THE HOLOCENE LANDFORM

On the basis of the geoarchaeological assessment, and in response to two planned undertakings (excavation of soils and creation of a wetland bank), investigations were conducted on the Holocene landform in September and November 2005. Modern fill soils were removed mechanically in five areas (1-5), each 15 meters (50 feet) square (Figure 3: Plate 1). Four, one-meter-square excavation units (EUs) were then investigated by hand in each of the five stripped areas: EUs 1-4 in Area 1, EUs 6-9 in Area 2, EUs 11-14 in Area 3, EUs 16-19 in Area 4 and EUs 21-24 in Area 5. Together, these resulted in a total of 20 square meters of hand excavation (Plate 2). Soil profiles were recorded by John Stiteler using standard soil terminology (see Appendix C), and by Hunter Research,

Inc. using more subjective macroscopic archaeological methods (Appendix D). The profiles included here (Figures 4 through 13) show both context numbers and standard soil horizon nomenclature.

Excavation Unit 1 (Figure 4)

EU 1 was located in Area 1, in the northwest portion of the focused study area, about 45 meters south of BHT 4 of the preliminary study. Beneath a remaining cap of 16 centimeters of fill, the profile consisted of an Apb1/Apb2/Bwb1/Bwb2/BC sequence. The Apb1 and Apb2 horizons, with a combined thickness of 28 centimeters, were formed in very fine and fine sandy loam, respectively. The Bwb1 horizon was formed in silt loam and the Bwb2 in sandy loam to loamy sand. The boundary between the two was abrupt, marking a scour surface, and the Bwb2 was present only in the northern two-thirds of the unit, being truncated by a scour channel in-filled with Bwb1 material in the southern one-third. The BC horizon, beginning at about 90 centimeters below the base of fill, was loamy sand free of gravel. At the time of my examination, lag gravels had not been exposed at the base of the excavation (110 centimeters below base of fill). Structure was moderately developed throughout the profile. The Bwb2 and BC horizons were slightly redder in hue than the Bwb1 (7.5YR4/6 vs 10YR4/6).

Excavation Unit 6 (Figure 5)

The south wall of EU 6 exhibited a profile representative of Area 2 in the north-central part of the focused study area. Stripping had removed the upper 22-25 centimeters of the profile. Below this, the profile consisted of an Ap1/Ap2/AB/Bw1/Bw2 sequence to base of excavation at 92 centimeters below base of stripping. A loamy sand BC horizon was exposed in the floor of the excavation. The profile to the base of the Bw1 horizon was formed in silt loam and the

Bw2 horizon, from 75 to 92 centimeters below base of stripping, was a sandy loam. The profile was generally free of gravel, though several small matrix-supported cobbles were present in the Bw1 horizon. These showed no obvious cultural affiliation and were, in all likelihood, a product of ice-rafting.

Excavation Unit 7 (Figure 6)

The east wall profile of EU 7 consisted of an Ap1/Ap2/AB/Bw/BC sequence, with all horizons above the BC formed in silt loam. The Ap horizons had a combined thickness of 60 centimeters, constituting nearly half the profile. The BC horizon (120-135 centimeters below the surface) was loam to loamy sand containing 3-5% gravel at the base of excavation. Structure was moderately developed in the Bw horizon and the BC horizon was slightly redder than the Bw, as in EU 1.

Excavation Unit 12 (Figure 7)

The west wall profile of EU 12 was representative of profiles seen in Area 3. Mechanical stripping had removed the upper 20 centimeters of the profile. The intact profile consisted of an Apb/Bwb1/Bwb2/Bwb3/BC sequence to base of excavation at 105 centimeters below stripping. Soil texture was silt loam in the Apb, Bwb1 and Bwb2 horizons, coarsening slightly to fine sandy loam in the Bwb3 and to loamy sand in the BC horizon. The Bwb2 (50-70 centimeters below stripping) was a transitional horizon, containing noticeably more fine sand than the Bwb1 and a small amount of fine and medium rounded gravel not seen in overlying horizons. The boundary between the Bwb3 and BC horizons sloped to the north and west (toward red Clay Creek).

Excavation Unit 16 (Figure 8)

The south wall of EU 16, the location of which was stripped to 25 centimeters below the original ground surface prior to unit excavation, exhibited a profile consisting of an Ap1/Ap2/Ab/Bwb1/Bwb2/BC sequence to base of excavation at 75 centimeters below stripping. Plastic was present at the boundary between the Ap1 and the thin (5 centimeters) Ap2. The Ab horizon (22-30 centimeters below stripping) was not well expressed and may have been a product of illuviated fine organic matter and iron that has moved down from the overlying horizons. Alternatively, it may be the remnant of a weakly developed late pre-historic/contact period surface that was covered by historic deposition prior to commencement of plowing and so preserved.

Excavation Unit 18 (Figure 9)

EU 18 was located in an area where 25 centimeters of the surface had been removed by stripping, leaving about 6 centimeters of AC horizon formed in a flood deposit at the top of the profile. Below this was an Apb1/Apb2/CB/Bwb/BCb sequence. The Apb2 horizon was thin (7 centimeters). The CB horizon, from 37 to 47 centimeters below stripping, consisted of 10-15 thin strata of sand, sandy loam and silt loam. It appeared to be the depositional product of a single large flood and was, in turn, quickly buried, preventing bioturbation and mixing of the strata. The underlying Bwb horizon (47-72 centimeters below stripping) was formed in sandy loam and the BC horizon (to base of excavation at 86 centimeters below stripping) was a loamy sand. Gravel in the same matrix formed the floor of the unit.

Excavation Unit 19 (Figure 10)

The profile of EU 19 was similar to that of EU 18, though the CB horizon was thinner (1-3 centimeters) and was not present throughout the unit walls. A Bwb1 of silt loam was present in lieu of the CB and a sandy loam Bwb2 from 50 to 72 centimeters below stripping corresponded to the Bwb of EU 18.

Excavation Unit 21 (Figure 11)

EU 21 was located about 15 meters from the left bank of Red Clay Creek. Mechanical stripping had removed 50 centimeters of fill and historic deposition. The upper 50 centimeters of the remaining profile consisted of an Apb1/Cb/Apb2 sequence. The Cb horizon, from 23 to 32 centimeters below stripping over most of the unit and thinning to the southwest, was made up of rounded gravel and rip-up clasts of red clay in a matrix of coarse sand. The silt loam Apb1 and fine sandy loam Apb2 horizons were both reduced as a result of being buried. The remainder of the profile consisted of a silt loam Bwb1 horizon coarsening with depth to fine sandy loam and a sandy loam Bwb2 horizon to base of excavation at 85 centimeters below stripping. Structure was moderate medium subangular blocky in the Bwb1 and moderate coarse subangular blocky in the Bwb2. Augering in the base of the unit revealed that the Bwb2 extended to 95 centimeters below stripping, overlying a thin C horizon of sand. The auger was refused at 100 centimeters below stripping.

Excavation Unit 22 (Figure 12)

EU 22 was located 5 meters south of EU 21. Mechanical stripping had removed the upper 110 centimeters, including the Apb1 and Apb2 horizons. The Ap horizons here were separated only by a thin (1-2 centimeters), discontinuous sandy Cb horizon, contrasted

to the 9-10 centimeter Cb horizon seen in EU 21. The Apb2 horizon was only 12 centimeters thick, suggesting that it may have been scoured by the flood that deposited the sandy C material. The remaining profile consisted of a silt loam Bwb1 horizon from base of stripping to 40 centimeters and a sandy loam to coarse sandy loam Bwb2 horizon to base of excavation at 45 centimeters. Augering revealed that the Bwb2 was about 10 centimeters thick, overlying a C horizon of coarse sand as in EU 21. The auger was refused at 65 centimeters below stripping.

Excavation Unit 23 (Figure 13)

EU 23 was located 10 meters south of EU 22. Mechanical stripping had removed the upper 80 centimeters, including the Apb horizon. There was no clear break defining an Apb1 and Apb2 horizon as seen in most units but the Apb horizon seen in the edge of the stripping was 30 centimeters thick and somewhat coarser in the upper two-thirds, suggesting accretion by historic floods. The profile remaining below stripping consisted of silt loam Bwb1 and Bwb2 horizons and a very fine sandy loam Bwb3 horizon, each 23-25 centimeters thick. A stone line consisting of a single course of fine round gravel separated the Bwb2 and Bwb3 horizons. Structure of the Bwb1 was moderate coarse parting to moderate medium subangular blocky, that of the Bwb2 moderate medium prismatic parting to moderate fine subangular blocky and that of the Bwb3 moderate very coarse prismatic parting to moderate coarse platy. The lower part of the profile was a sandy loam BCb from 75 centimeters to base of excavation at 88 centimeters below stripping. Augering showed that the BCb extended to 95 centimeters below stripping, overlying 10 centimeters of coarse sand C horizon. The auger was refused at 105 centimeters below stripping.

E. ASSESSMENT AND RECOMMENDATIONS

As it flows through the crystalline bedrock of the Piedmont province upstream from the study area, Red Clay Creek is confined within a relatively narrow and steep-sided valley. The study area, just downstream from the point at which the creek enters the Coastal Plain province, constitutes the first opportunity for the creek to expand and drop its sediment load during high flows. The stream valley is bounded on the west by the base of a low upland and overbanking waters are forced to the east, into the study area. The sediment load and flow of the second order tributary that enters from the west at the upstream end of the study area contribute to the overbanking and probably also serve to force Red Clay Creek to the east.

Soil profiles revealed that, to some degree, the floodplain manifests a particle-size gradient fining in the downstream direction. The coarsest sediment tends to be deposited at the upstream end as soon as the floodwaters have an opportunity to spread out and lose velocity. Soils of the wider, middle part of the landform appear to have a higher component of silts while the downstream end, especially the tributary hollow, appears to be subject to frequent ponding, resulting in formation of poorly drained, clay-rich soils.

At the narrow upstream end of the floodplain, sands deposited immediately upon overbanking have produced a natural levee that extends most of the way across the landform. This has resulted in formation of a flood chute along the distal edge of the floodplain, where flow is trapped between the levee and the base of the scarp leading to the higher terrace. The chute is well expressed along the narrow upstream end of the floodplain but as the floodplain expands and the levee is less well-defined, the chute widens and becomes shallower, finally becoming so diffuse that it is no longer visible at around the point at which an access road enters the study area. Before disappearing entirely, the chute swings slightly to the west, away

from the base of the scarp. BHT profiles revealed a higher incidence of isolated cobbles and gravel in the silt loam and fine sandy loam Bwb1 and Bwb2 horizons within the chute than seen elsewhere on the floodplain. These are probably products of ice rafts swept into the chute and stranded there during late winter/early spring floods.

Nearly all of the profiles seen in BHTs and EUs in the northwestern portion of the study area were characterized by a single, late Holocene fining-upward sequence overlaid by a cap of historic to recent deposition and fill. The historic to recent material that was clearly fill or recent flood deposition varied in thickness from 12 to 100 centimeters. In most cases, a plowzone (Ap or Apb horizon) identified between the base of historic deposition and the fining-upward sequence was interpreted to be made up largely or entirely of historic deposition. The plowzone was frequently slightly coarser than the underlying Bwb1 horizon, suggesting that the plow zone is made up, at least in part, of alluvium produced by historic floods of increased frequency and energy.

Many profiles, particularly those seen in the Phase II excavation units, contained two plow zones (Apb1 and Apb2 horizons). These took the form either of thickened (accreted) plow zones with distinguishable upper and lower zones or of two distinct horizons separated by a thin layer of coarse flood deposits. In these cases, the uppermost plow zone is clearly formed entirely in historic deposition and in all likelihood the lower one is also made up largely or entirely of historic alluvium. Generally speaking, the discrete Apb2 horizons overlaid by flood deposits were thin, probably as a result of truncation by scouring floodwaters.

The fining-upward sequence, from a relatively thin cap of sand or loamy sand overlying rounded gravel and cobbles through sandy loam and fine sandy loam to silt loam, averaged about 1 meter in thickness. The surface of the gravel and cobbles was generally 0.25

to 0.5 meters higher in elevation than the surface of gravel bars flanking the modern stream channel. The overlying sand or loamy sand, interpreted to be lateral deposition, averaged 10-20 centimeters in thickness. This material was deposited on side bars or aggrading point bars within the boundaries of the active stream channel. The sandy loam in the profile (generally, the Bwb2 and/or Bwb3 horizon) is a product of either overbank deposition immediately adjacent to the channel or deposition on the higher elevations of prograding point bars.

The silt loam, which generally constitutes a third to a half of the prehistoric soil profile, is overbank deposition. Structure was moderately developed in the Bw horizons and there was weak to moderate development of color produced by in situ weathering and accumulation of iron, both suggesting that the sediments have been in place and relatively stable for a thousand to several thousand years. However, no evidence was seen in any of the soil profiles of extensive clay translocation and formation of argillic subsurface horizons. If present, argillic horizon formation would indicate long-term stability. In view of the dearth of argillic characteristics and the generally moderate degree of soil formation exhibited it is likely that the sediments making up the northwestern half of the study area are products of late Holocene deposition.

Variations in the thickness of the silt loam, sandy loam and sand components of the profile reflect several aspects of the dynamic character of floodplain formation. To some extent the variability reflects the undulating ridge-and-swale form of point bar formation, with thicker silt deposits present where overbank flooding has filled swales with medium-textured material. Much of the variability is also a product of post-depositional dynamics. There was clear evidence in several profiles of erosion by channelized overbank flows. In some cases these eroded flood

chutes were subsequently filled by silts and in some cases coarse-textured, high energy deposits were inset into finer-textured horizons.

No marked difference was seen in the degree of soil formation across the landform from the base of the terrace scarp to the area proximal to Red Clay Creek. This, coupled with the small component of point bar sands in the profiles, suggests that the creek transgressed relatively rapidly across the area now occupied by the floodplain and has been established in or near its present position for much of the time that the floodplain has been forming. Though wide in comparison to the reaches of stream valley in the Piedmont immediately upstream, the study area valley floor is a relatively confined setting for a stream with such an extensive and hilly drainage basin. Within the study area, the Red Clay Creek valley is confined on the right by bluffs marking the edge of an upland and on the left by the scarp older terrace. The width of the floodplain varies from 2 to 4 times that of the active channel including the scour plain and actively forming side and point bars. This indicates that the dynamic creek could have reworked its entire floodplain within a comparatively short time by a minimum of channel migration or avulsions, as it almost certainly has several times over the course of the Holocene.

The lobate form of the higher terrace which is the site of the Glenville Estates development strongly suggests that the wide, poorly drained hollow which forms the eastern half of the study area was formerly the downstream reach of a looping meander bend of Red Clay Creek. This is supported by the 1906 USGS 15 minute Wilmington quadrangle map. The map indicates that at that time the hollow contained a small channel connecting Red Clay Creek to Hershey Run in the adjacent drainage and open to both streams with no evidence of a drainage divide. The upland just east of the study area is identified on the historic and current maps as Bread and Cheese Island, though it is now a peninsular upland between the two stream

drainages, a section of the open channel shown on the 1906 map having apparently been obliterated by subsequent filling and development.

It is likely that Red Clay Creek occupied the hollow during the late Pleistocene low stand of the Atlantic Ocean associated with the Wisconsinian glaciation and continued to occupy it into the Holocene. Abandonment of the hollow and avulsion of Red Clay Creek to form its current confluence with White Clay Creek is, in all likelihood, related to sea level rise with resultant base level rise for the Christina River and gradient decrease in the lower reaches of tributaries such as Red Clay and White Clay Creeks. Abandonment of the hollow probably occurred relatively recently (i.e., within the late Holocene), inasmuch as a small channel was kept open only by shallow groundwater flow and occasional flushing by large floods. Avulsion of Red Clay Creek caused the hollow to become a backwater for both Red Clay Creek and Hershey Run, producing ponding during floods, slackwater deposition and the poorly drained conditions seen today.

No organic material, carbon, diagnostic artifacts or other means of dating were recovered from the north-western half of the study area in the course of the study. Estimation of the age of the landform must therefore be based on the degree of soil development. On this basis it appears that the floodplain has formed over the last 1,000-2,000 years.

Theoretically, there is a potential for the presence of Middle through Late Woodland cultural material in the sediments of the silt loam Bwb horizons throughout much of the western half of the study area and a lower potential in the sandy loam Bwb horizons. The Apb2 horizons and lower zones of the thick, accreted Apb horizons also may have some potential insofar as they may be made up of a mixture of prehistoric and historic sediments. Despite this theoretical potential, no cultural material was recovered in the course of archaeological fieldwork at the study area. This

suggests that the floodplain may have been subject to flooding on a frequent enough basis to make it an unattractive habitation site, particularly given the presence of the extensive higher, well-drained terrace immediately adjacent. The floodplain may instead have been a locus for activity that left little or no material record, such as horticulture.

The information generated by this study will be useful in evaluating the archaeological potential of similar landforms at the Piedmont/Coastal Plain junction. Overall, it appears that although there is some accretion in this portion of the floodplain, it was still subject to flooding and some scouring and was therefore not attractive for permanent or seasonal settlement or encampment. It is concluded that the landform does not contain archaeological resources that would meet National Register criteria and therefore a finding of No Effect from the Undertaking may be made in accordance with 36 CFR 800.4.

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